XIV. *Description of an Instrument for ascertaining the specific Gravities of Fluids.* *By* John Godfrey Schmeisser. *Communicated by Sir* Joseph Banks, *Bart. P. R. S.*

Read May 16, 1793.

ALTHOUGH it be well known to chemists, as well as to experimental philosophers in general, that the ascertaining the specific gravities of bodies is a matter of great importance in various chemical experiments, as well as in the analysis and chemical investigation of different substances; yet we find that this precaution is too frequently neglected in the accounts given of the experiments by the authors themselves, and that the neglect of it has sometimes occasioned the failure of these very experiments, when repeated by others.

As this defect has, in a great measure, arisen from the want of an accurate and convenient apparatus, a defect which I have formerly experienced myself, I have for some time past employed my thoughts in inventing a contrivance by which this difficulty might be removed. I flatter myself that I have now succeeded; having contrived an instrument, which I have found to answer every purpose for which it was intended, to my great satisfaction; so that the specific gravities of fluids may be determined in an easy and accurate manner.

Every ingenious man will easily convince himself in what respect this instrument may differ from, or how far it may be

preferable to, those which have been hitherto made public; and even to that lately invented and recommended by Mr. RAMSDEN.

The whole apparatus is represented in Tab. XIX. fig. 1; it consists of a flat-bottomed glass bottle (fig. 2) in which is fitted, by grinding, a glass stopper having a thermometer passing through it, (fig. 3.) The bore of this stopper is conical, (fig. 4) and the thermometer has a glass collar, (fig. 5) which is ground into the bore of the stopper, so as to be perfectly tight. There is some difficulty both in making the glass collar, and in fitting it into the stopper. If the thermometer tube and the collar be not made of the same metal, the collar is very apt to fly off in grinding; for this reason I have sometimes fixed the tube into the stopper by means of a thin piece of elastic gum, wound very tight round the tube. This gum, by its elasticity, effectually excludes air and liquids, and is, in the usual temperature of the atmosphere, not dissolved by any liquor, except vitriolic æther, and not even by that, unless it is particularly prepared for the purpose.

The cavity left at the upper part of the stopper may be filled up with sealing wax, or any other kind of cement; this will assist in fixing the tube, and as the liquors to be weighed do not come in contact with this part, if the bottle be carefully filled, there is no danger that the wax, or cement made use of, should in any degree affect the accuracy of the experiments.

I have made, at different times, comparative experiments with this instrument, with a view to the further ascertaining its accuracy, and the different improvements made in it; and I can with much confidence assert, that I have never

found either the least difference in the results, or any thing else contrary to my expectations.

The manner of using this instrument, and preparing it for experiments, is as follows.

(1.) A. An accurate cubic inch, which is fastened, by means of a horse-hair, to a hydrostatic balance, is to be suspended in a vessel with distilled water, of the temperature of 60 degrees, according to FAHRENHEIT; when the sum of the weight which the cubic inch thus loses, in the water, will be equal to the weight of an equal quantity of water displaced by it.

(2.) B. The instrument, free from moisture, is then to be put into the scale of an accurate balance, and its weight ascertained, from which the weight of the common air contained in the bottle must be deducted; when the remainder will indicate the absolute weight of the instrument.

(3.) C. The bottle of the apparatus is then to be filled with distilled water, of the temperature of 60 degrees, and the stopper, with the thermometer, fitted to the bottle, so that neither the smallest bubble of air may remain in it, nor any of the fluid adhere to the outside of the stopper or bottle; after which the weight of the water is to be ascertained, and marked upon the bottle, from which, by calculation according to experiment A, the quantity of water, contained in the bottle in cubic inches measure, may be found. Having thus ascertained the quantity of water of 60 degrees of temperature which the bottle contains, the bottle may then be filled with any other fluid of the same temperature, and its weight ascertained, according to experiment C, and compared with that of distilled water. If, for example, the bottle be found

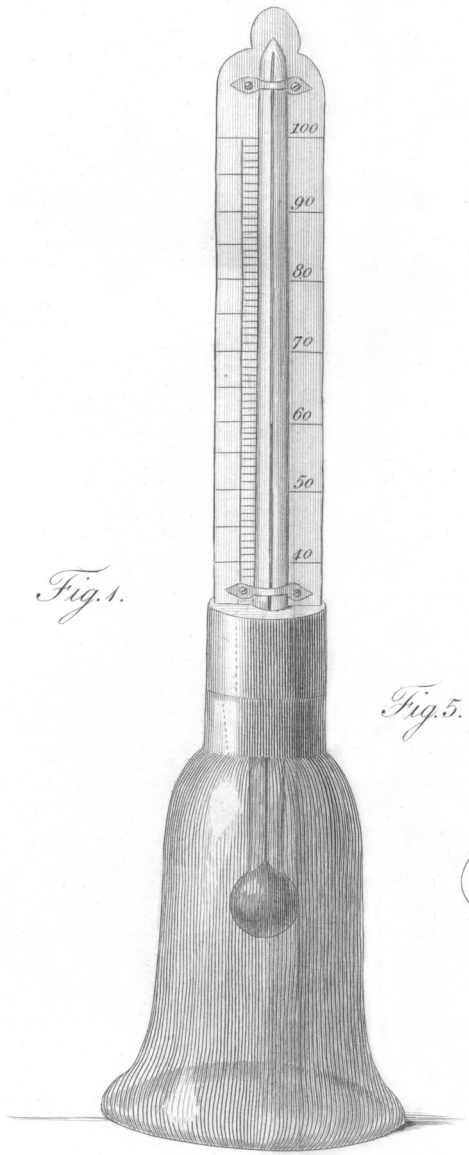

Fig. 1.

Fig. 5.

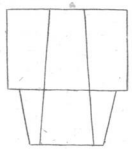

Fig. 4.

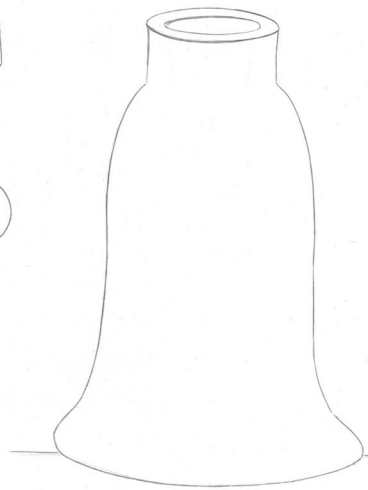

Fig. 2.

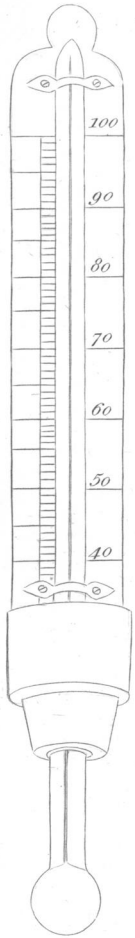

Fig. 3.

to contain 327 grains of distilled water, and 654 of another fluid, the difference will be as 1 to 2; or 654 divided by 327, will give 2 for the quotient. The specific gravity then, of the fluid thus found, compared with that of distilled water, is properly expressed by the ratio 2,000 : 1,000; which latter expression is taken for the standard.

As it is a known fact that fluids exhibit different specific gravities at different temperatures, it would have been necessary for me to form a table, exhibiting the specific gravities of fluids at different temperatures, had I not, in order to avoid this inconvenience, hit upon a method of bringing the fluids, whose specific gravities are to be investigated, to a certain standard, viz. to 60 degrees, by setting the bottle with the fluid in a glass vessel with cold water, and adding as much warm water as may be necessary to bring that fluid to this standard of 60 degrees.

As the fluor acid will in some measure dissolve the glass, it becomes necessary, when that acid is to be weighed, to coat the inside of the bottle, by melting a little bees-wax in the bottle, and turning it, with the thermometer, in such a manner that the inside, together with the lower part of the thermometer, may become totally covered when cooled; which coating may easily be removed by means of a little oil of turpentine, or any other essential oil, all of which dissolve wax very readily.